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About the Cover

The Nation's Capital welcomed *Columbia*'s astronauts, John Young and Bob Crippen May 18–20 with a series of special events held in their honor as the prime crew of the first flight of the Space Shuttle. At a White House ceremony held May 19, President Reagan presented both astronauts with the NASA Distinguished Service Medal, noting that the Columbia's successful maiden flight "promises continued U.S. preeminence in space." In addition, Young received the Congressional Space Medal of Honor in recognition of his two decades as an astronaut during which he made five spaceflights. President Reagan presented NASA Acting Administrator, Alan Lovelace, with the President's Citizens Medal in honor of Lovelace's leadership in the Space Shuttle program. Young and Crippen later attended a ceremony at NASA Headquarters (photo below) where they were presented a painting by artist Hugh Laidman entitled "Astronauts John Young and Bob Crippen in Conference." This painting was one of a series of watercolors done during the 56-hour mission simulations at Johnson Space Center, Houston, in June 1980. Young and Crippen presented an American flag carried aboard the *Columbia* to the employees of NASA, in appreciation for the "great team effort which made the first flight of the Space Shuttle possible."

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Nominations Submitted for Top Two NASA Posts

President Reagan announced April 23 his intention to nominate business executive James Montgomery Beggs to become Administrator of NASA and Dr. Hans Mark as Deputy Administrator.

Beggs

Beggs has been Executive Vice President, Aerospace, and a director of General Dynamics Corp., St. Louis, Mo. Mark is former Secretary of the Air Force and former Director of NASA's Ames Research Center, Mountain View, Calif.

Beggs, if confirmed, will succeed Dr. Robert A. Frosch who resigned on Jan. 20, 1981, to take over as the first president of the American Association of Engineering Societies in New York. Frosch had been Administrator since June 21, 1977.

Beggs, who will be the sixth man to head the nation's civilian space agency, has been responsible for General Dynamics Convair, Electronics, Fort Worth and Pomona Divisions.

He served with NASA in 1968-69 as Associate Administrator, Office of Advanced Research and Technology. From 1969 to 1973, he was Under Secretary of Transportation. He went to Summa Corp. as Managing Director, Operations and joined General Dynamics in January 1974. Before joining NASA, he had been with Westinghouse Electric Corp. for 13 years.

Beggs is a 1947 graduate of the U.S. Naval Academy and served with the Navy until 1954. In 1955, he received a master's degree from the Harvard Graduate School of Business Administration.

A member of the Board of Governors of the National Space Club, the National Security Industrial Association and the American Astronautical Society, Beggs' other professional affiliations include the National Academy of Public Administration, the American Institute of Aeronautics and Astronautics, the American Society of Naval Engineers and Sigma Tau.

He holds an honorary LL.D. degree from Washington and Jefferson College, Washington, Pa., and an honorary doctor of engineering management degree from Embry-Riddle Aeronautical University, Daytona Beach, Fla.

Mark

Hans Mark served as Secretary of the Air Force from July 1979 to 1981. He had served as Under Secretary since 1977.

A physicist and nuclear engineer, he joined NASA's Ames Research Center in February 1969 and prior to that was a professor and researcher and had served as a consultant to several government agencies and held a number of university committee assignments. He was chairman of the Department of Nuclear Engineering at the University of California, Berkeley, from 1964 to 1969 and was administrator of the Berkeley Research Reactor during the same period.

Born June 17, 1929, in Mannheim, Germany, Mark came to the United States in 1940 and became a citizen in 1945. He received his bachelor's degree in physics from the University of California at Berkeley in 1951 and a doctorate in physics from Massachusetts Institute of Technology in 1945.

Mark has taught undergraduate and graduate courses in physics and engineering at Boston University, Massachusetts Institute of Technology and the University of California at both the Berkeley and Davis campuses and held an appointment as consulting professor of engineering at Stanford University.

Target Date Set for Second Shuttle Launch

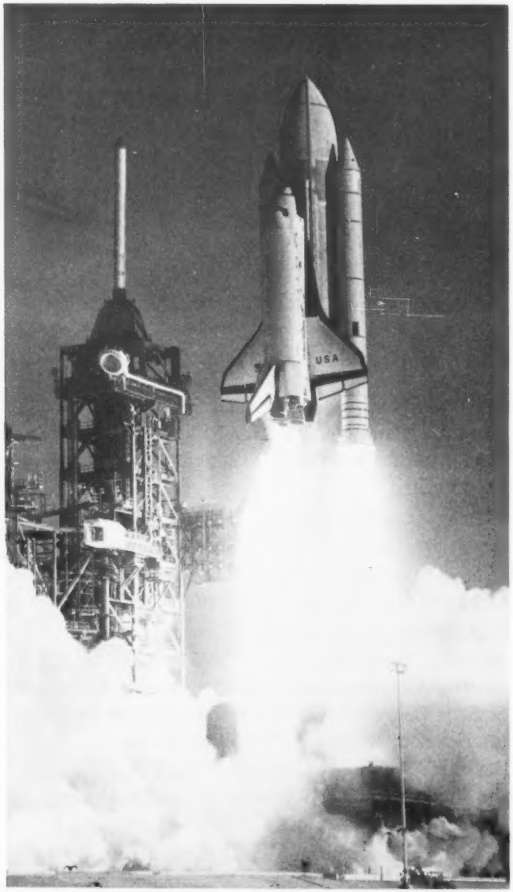
A target launch date of Sept. 30, 1981 has been set for the second flight of the Space Shuttle *Columbia* following an assessment of modifications and test requirements.

NASA officials emphasize, however, that this date is success oriented and involves the first time that the *Columbia* will be "turned around" for a successive flight. Unforseen problems could occur which would impact the work schedule and cause a slip in the launch date.

Then and Now

NASA recently celebrated its 20th anniversary of manned spaceflight. On May 5, 1961 Alan Shepard became the first American launched into space aboard the Mercury Redstone 3 (shown at left). His capsule was named the Freedom 7. Launched from Complex 5/6 at Cape Canaveral Air Force Station, Fla., the Redstone boosted the Mercury spacecraft containing Shepard on a ballistic trajectory that peaked 116 miles above the Earth's surface and brought Freedom 7 to a splashdown in the Atlantic Ocean about 300 miles downrange from the launch site, a space journey that lasted only 15 minutes.

At right is the launch of the first Space Shuttle *Columbia* on April 12 from Launch Complex 39A, Kennedy Space Center, Fla. The *Columbia's* successful 2½-day earth-orbital mission heralded the beginning of a new Space Transportation System in which the United States will enter the reaches of space not only to explore but to perform varied experiments and tasks. The Shuttle is the world's first aerospace vehicle—a spacecraft that launches like a rocket and lands like an airplane. The thrust of the *Columbia,* propelled by a simultaneous thrust of twin solid rocket boosters and three main engines, was approximately 6.5 million pounds; the liftoff thrust of the Redstone 3 in May 1961 was less than one percent of that of the *Columbia.*



Searing Venus Surface Heat Caused By Greenhouse Effect

Using NASA's Pioneer-Venus spacecraft data, a team of scientists has virtually proved that the searing 482 degree Celsius surface temperature of Venus is due to an atmospheric greenhouse effect. Until now the Venus greenhouse effect largely has been a theory. The work is important to understanding possible adverse effects on agriculture resulting from society's long-term use of fossil fuels.

Greenhouse effect means that the surface temperature is raised when energy in the form of sunlight easily passes through Venus' atmosphere to the surface but has difficulty escaping when converted to longer-wave heat radiation, and is held in by the atmosphere. The same principle provides much of the heat for nursery greenhouses on Earth.

Calculations, which used Pioneer measurements of atmosphere composition, temperature profiles and radiative heating, predicted Venus' surface temperature "very precisely," says Dr. James Pollack of NASA's Ames Research Center, Mountain View, Calif., head of the Pioneer-Venus radiative heating team. The calculations predict not only Venus' surface temperature, but agree with temperatures measured at various altitudes above the surface by the four Pioneer Venus atmosphere probe craft.

Members of the radiative heating team were Dr. Pollack; Dr. Martin Tomasko, University of Arizona; and Dr. Brian Toon, NASA Ames. Data from a large portion of the 30 instruments aboard the Pioneer Venus orbiter and probes craft were used in the calculations.

The accuracy of the Venus atmospheric heat balance predictions increases the confidence of scientists for making similar predictions for the Earth, including the effect on Earth's atmospheric heat budget caused by the burning of fossil fuels.

The main atmosphere ingredient holding in Venus' heat is carbon dioxide. Eighty years of burning fossil fuels on Earth has increased atmospheric carbon dioxide by 15 percent. Predictions of increased burning of fossil fuels like coal and oil suggest that the carbon dioxide in Earth's atmosphere could be doubled in 50 years.

Researchers point out that resulting heat trapping by carbon dioxide could raise average atmosphere temperatures from 1.5 to 4 C above current temperatures.

This is minor compared to the inferno of Venus' surface. Nonetheless, such a temperature increase could well cause "incredible havoc," says Dr. Pollack. (During the most severe phases of the Earth's ice ages, average atmospheric temperature drop has been only 7 C). Examples of major weather changes resulting from a 1 to 3.5 C (2 to 7 F) change in average temperatures might include catastrophic differences in rainfall in marginal agricultural areas such as wheat-growing regions of Canada, the U.S.S.R. and the United States.

Such temperature changes also might melt a small but important portion of the polar ice caps—enough to raise ocean levels and cause permanent flooding in major coastal cities.

Having calculated atmospheric heating for Venus (which is almost the most extreme case imaginable), calculations of carbon dioxide effects on Earth's atmospheric heat budget should be much easier. While these predictions of carbon dioxide effects on the Earth's atmospheric temperature may be overstated, Pollack points out, we should determine whether they are or not, and Venus greenhouse data will certainly help.

Only half of the carbon dioxide so far sent into the Earth's atmosphere by human fossil-fuel burning has stayed there. The rest apparently has been absorbed into the oceans. However, ocean absorption effects have been included in the scientists' calculations of carbon dioxide doubling.

Pollack explains that Venus' surface temperature of 482 C is remarkable. The planet is only 30 percent closer to the Sun than Earth, and with a relatively thin atmosphere like Earth's, its surface temperatures might be expected to be around a warm but habitable 38 C.

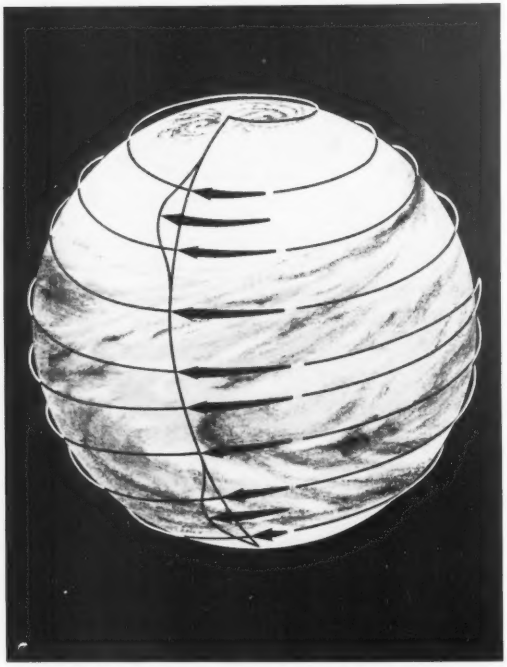
Earth's existing greenhouse effect heats up our planet's surface some 36 C, while Venus' surface temperature is wrenched upward by 425 C due to the greenhouse effect. This happens despite the fact that Venus currently absorbs less solar energy than the Earth. Venus' highly reflective clouds bounce back much of its incoming solar energy (sunlight) to space.

Calculations by the Pioneer team, using data from the Pioneer Orbiter and measurements by the four probe craft, which sampled the atmosphere from top to bottom, have characterized Venus' greenhouse exactly. The team now has established exact amounts of sunlight absorbed at various places in the atmosphere and at the surface.

They have established the role and amount of heat trapping by the various gases and particles in Venus' atmosphere. These include carbon dioxide, water vapor, sulfur dioxide and various types of cloud particles. Finally, Venus' planet-wrapping haze layer provides a "cap" to the greenhouse, explaining the last 12 to 15 C of temperature. These calculations, in general, balanced the amount of sunlight absorbed with the heat radiated to get the temperature at various points.

Water vapor amounts reported by the Russian Venera spacecraft were used in the greenhouse calculations instead of the Pioneer measurements because they fit well with all the rest of the data. The amount of water vapor finally decided on was much less than had been thought required to produce the planetary greenhouse effect. The team found that the remaining heat expected to be absorbed by water vapor was, instead, absorbed by sulfur dioxide and Venus' heavy clouds.

Carbon dioxide, which makes up 96 percent of Venus' massive atmosphere, had by far the largest role in trapping heat on the planet. Water vapor and sulfur dioxide also trapped important amounts of heat, as did the clouds and planet-enveloping haze layer. The calculations include heat absorption by carbon dioxide in long heat radiation wave lengths that this gas does not normally absorb. However, under Venus' enormous atmospheric pressure, carbon dioxide absorbs heat even at very long wavelengths. Amounts of heat taken up by the various key absorbers in Venus atmosphere were: carbon dioxide, 55 percent; water vapor, 25 percent; clouds and haze, 15 percent; and sulfur dioxide, 5 percent. The Pioneer project is managed by NASA's Ames Research Center, Mountain View, Calif.



The atmosphere of Venus circles the planet once every four days at the cloud tops. Closer to the surface, the planet's massive atmosphere travels much more slowly. Data from NASA's Pioneer Venus spacecraft has shown that the searing surface temperature of Venus is due to an atmospheric greenhouse effect. The surface temperature of the planet is raised when energy in the form of sunlight passes through the atmosphere but cannot readily escape when converted to longer-wave heat radiation and is held in by the planet's atmosphere.

NASA Consolidates Center Operations

NASA is consolidating its Dryden Flight Research Center under Ames Research Center management and its Wallops Flight Center under Goddard Space Flight Center management.

Under the consolidations, the Dryden Center at Edwards, Calif., becomes an operational element of Ames, Mountain View, Calif.; and the Wallops Center, Wallops Island, Va., becomes an operational element of Goddard, Greenbelt, Md. The Dryden and Wallops centers will retain their identities but will be under the overall management and direction of Ames and Goddard, respectively.

Dr. Alan M. Lovelace, NASA Acting Administrator, said the consolidations will focus the resources of each of the installations on what it can do best. "The close relationship between Ames' and Dryden's efforts in aeronautical programs and Wallops' and Goddard's efforts in suborbital programs, as well as the unique facility capabilities and the physical proximity of the installations provides an opportunity to improve overall program effectiveness through these consolidations," Lovelace said.

Flight research operations for Ames will be carried out primarily at Dryden and sounding rocket development and operations for Goddard will be carried out primarily at Wallops. The consolidations are expected to be completed by Oct. 1, 1981.

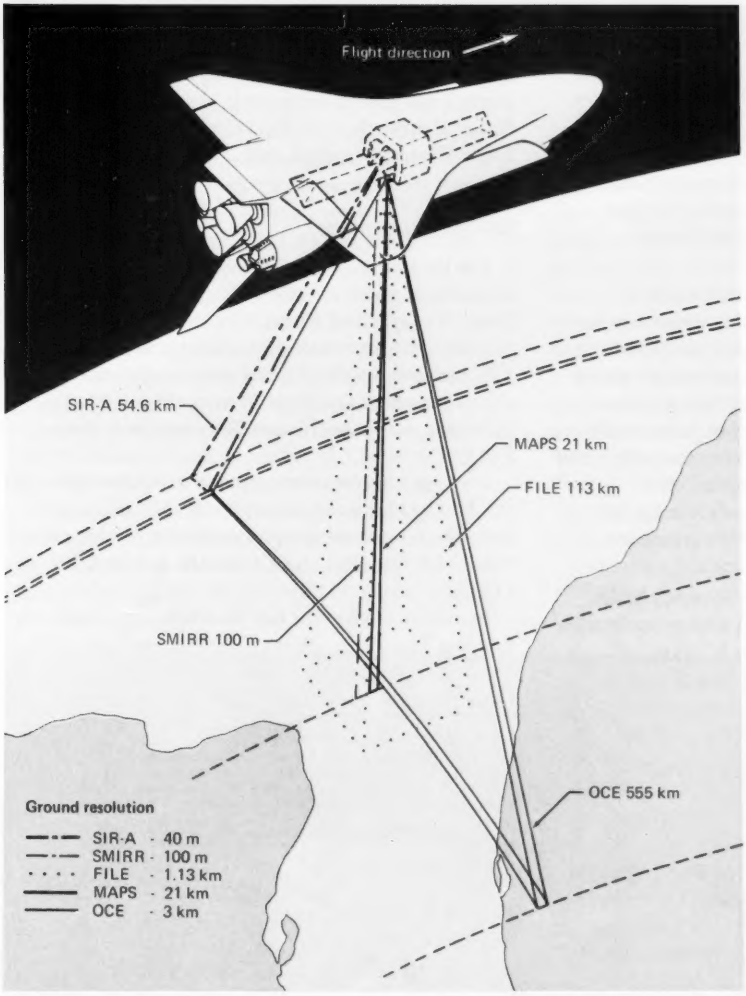


Diagram showing ground coverage and resolution for the five experiments of OSTA-1, the first scientific and applications payload to fly aboard the Space Shuttle, scheduled for its second flight in October. The Shuttle Imaging Radar (SIR-A) and Shuttle Multispectral Infrared Radiometer (SMIRR) are concerned with remote sensing of land resources; Feature Identification and Location Experiment (FILE) focuses on the problem of data management; Measurement of Air Pollution from Satellites (MAPS) is concerned with remote sensing of atmospheric quality; and Ocean Color Experiment (OCE) performs remote sensing of ocean conditions.

First Space Shuttle Payload Readied

NASA scientists and engineers at Kennedy Space Center, Fla., are making preparations to install the first payload to be carried into space aboard the Space Shuttle *Columbia* during STS-2, its second test flight, now scheduled for this fall.

The payload is called OSTA-1 for NASA's Office of Space and Terrestrial Applications which is providing most of the seven experiments. It is designed to demonstrate the Space Shuttle's capability as an operational space platform for scientific and applications research. The experiments are concerned primarily with remote sensing of land resources, atmospheric phenomena and ocean conditions.

The payload experiments include Shuttle radar to help test advanced techniques for mapping geological structures important in oil and gas exploration; a multispectral infrared radiometer to measure the solar reflectance of mineral-bearing rock formations; a feature recognition system designed to discriminate between water, bare ground, vegetation, snow or clouds and thus control sensors to collect only wanted data; an air pollution measurement

experiment designed to measure the distribution of carbon monoxide in the middle and upper troposphere (12–18 kilometers altitude); an ocean color scanner to map algae concentrations which may indicate feeding areas for schools of fish or pinpoint possible pollution problems; a night and day optical survey of lightning storms; and a biological engineering experiment to determine the relationship between plant growth and moisture content in the near weightlessness of space.

An engineering model of a Spacelab pallet, a 3-meter-long, U-shaped structure that mounts in the Shuttle's cargo bay, will carry most of the experiments. The pallet is equipped with subsystems which provide power, command, data and thermal interfaces for the instruments. The imaging radar, radiometer, feature recognition, pollution measurement and ocean scanner experiments are mounted on the pallet; the lightning and biological engineering experiments are mounted in the Shuttle's crew compartment.

STS-2 will be launched from the Kennedy Space Center into a 280-km circular orbit with an inclination of 40.3 degrees. For approximately 3.5 days (88 hours) of the four-day mission, the Shuttle will be in an Earth-viewing orientation. In this attitude, the Shuttle payload bay faces the Earth on a line perpendicular to the Earth's surface. During this period, the instruments will be operated and data collected. The mission will conclude with a landing at Dryden Flight Research Center, Edwards, Calif.

The flight operations of OSTA-1 will be controlled from the Johnson Space Center Payload Operation Control Center. The air pollution and feature recognition experiments operate continuously for the whole mission with the imaging radar, radiometer and ocean experiments taking data over preselected sites. The lightning experiment is a "target of opportunity" instrument. Experiment housekeeping data is available in the Payload Operation Control Center to monitor the status and health of the instruments, and the payload can be commanded from the control center, or by the astronaut crew via the Shuttle's general purpose computers.

Since most of the Shuttle data transmission capability will be utilized with Shuttle status data for the second orbital flight test mission, all the OSTA-1 scientific data will be recorded on board on tape and film. The tape and film will be removed from the Shuttle upon landing and turned over to the experimenters for immediate screening and analysis. The instruments will be removed from the Columbia after it is ferried to the Kennedy Space Center.

All scientific experiment data will be in the public domain and subsequently made available from the National Space Science Data Center, Goddard Space Flight Center, Greenbelt, Md.

In Remembrance

For the past 12 years, NASA has received contributions in support of the U.S. space program from Coley W. Jay, Chief Petty Officer, U.S. Navy (retired). His monetary gifts, each for the sum of $20, now totals $300. Chief Jay has made each donation in memory of his 19-year-old son, Phillip Arlen Jay, who was killed in Navy service in the Far East in 1952.

Jay began his monetary support to NASA following the Apollo 11 mission in July 1969 and continued through all subsequent Apollo missions (ending with Apollo 17, Dec. 1972), and Skylabs 1, 2, and 3 (1973).

Immediately after the first free flight Approach and Landing Test of the orbiter *Enterprise* on August 12, 1977, well wishes and the customary contribution from Chief Jay arrived at NASA Headquarters. NASA has since received a contribution from him in recognition of the 747 carrier aircraft crews who participated in the *Enterprise* Approach and Landing Test Flights; two other donations also have been made in memory of his son, Phillip, without reference to a specific space mission.

Jay's latest contribution, which brings the total to $300, is in recognition of the successful flight of the first Space Shuttle *Columbia,* whose 2½ day mission occurred April 12-14. In his accompanying letter dated April 14, Jay said: "Today my prayers were answered when astronauts Young and Crippen made history. . . . I feel we must continue to go forward with our space program. . . ."

All of Chief Jay's contributions have been deposited in the U.S. Treasury.

Editor's Note: An account of Chief Jay's years of support of the U.S. space program appeared in a May 9 issue of a local California newspaper, *The Manteca News*. The paper's publisher, Antone Raymus was so impressed with Jay's gestures of patriotism that he sent a monetary contribution to NASA Headquarters "in recognition of NASA and our two astronauts, Young and Crippen, for a job well done."

HEAO-2 Completes Mission

NASA's second High Energy Astronomy Observatory (HEAO-2) has expended its control gas supply, completing its flight mission. HEAO-2 is one of a family of three highly successful scientific satellites managed by NASA's Marshall Space Flight Center, Huntsville, Ala. With two years and five months of operation, HEAO-2, like its predecessor, HEAO-1, performed more than twice as long as its design called for—a feat expected to be equaled by the third observatory which is still in operation.

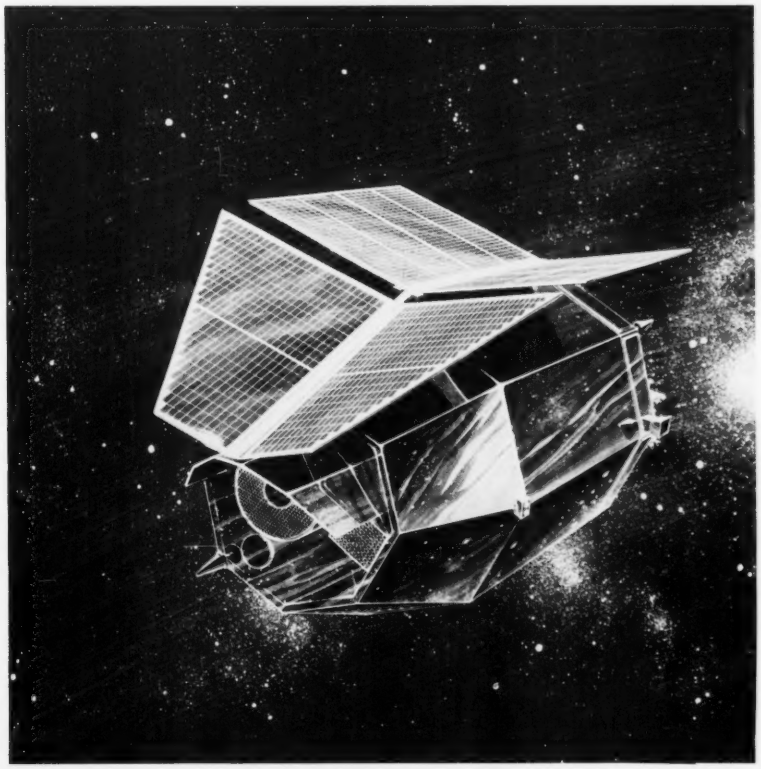
The HEAO-2 spacecraft was launched Nov. 13, 1978. It carried the world's largest focusing X-ray telescope and an array of imaging and analyzing astronomy instruments. During its extra-long lifetime, it performed thousands of studies of X-ray emitting stars, supernova remnants, galaxies and quasars.

Although it will take years for participating astronomers to completely analyze all the data they receive, important discoveries have already been made concerning the X-ray output of normal stars, the composition of supernova remnants, the distribution of mass in galaxies and clusters of galaxies and the origin of the extragalactic X-ray background.

The spacecraft was operating extremely well, Marshall Center officials reported, when it expended the last of its reaction control gas on April 25 and could no longer maintain its pointing attitude. Spacecraft and instrument engineering tests were performed until the batteries were discharged, and on a subsequent orbit the morning of April 26 when the solar panels were receiving sunlight, all systems were powered down. Reentry and burn-up are expected to take place next year.

Science direction for the HEAO-2 mission was provided by a scientific consortium which included the Smithsonian Astrophysical Observatory, Cambridge, Mass.; the Goddard Space Flight Center, Greenbelt, Md.; the Massachusetts Institute of Technology, Cambridge; and the Columbia Astrophysics Laboratory, New York City.

American Science and Engineering, Cambridge, was prime contractor for the telescope and



Artist's concept of NASA's second High Energy Astronomy Observatory (HEAO-2), launched Nov. 13, 1978. This satellite performed for more than twice its expected design life; flight mission for the satellite ended when the control gas supply was expended on April 25.

instruments. TRW Systems, Inc., Redondo Beach, Calif., was HEAO-2 prime contractor and developed, integrated and supported the operation of the spacecraft. Overall management and direction of the HEAO Project was performed by the Marshall Center.

Artists Record Columbia's Flight

A tradition nearly as old as the space program itself continued in April when artists recorded the events at Kennedy Space Center, Fla., of the first flight of the Space Shuttle Columbia for NASA.

For more than 18 years, NASA's art program has commissioned some of the nation's outstanding artists to render their impressions of key events in the space program. The artist donates time and talent in return for an honorarium to cover expenses.

The purpose of the agency's art program is to collect an archival history of the exploration of space. Artists have been present at Cape Canaveral as astronauts suited up for their flights and were launched into space, and they have been aboard recovery ships when the astronauts returned to Earth. They have flown simultors to experience at least a taste of what it is like to fly in space.

Participating artists have ranged from traditionalists such as Peter Hurd and James Wyeth, to modernists such as Robert Rauschenberg and Lamar Dodd. The art produced varies from subjects closely seen and sharply delineated to those only sensed or imagined by the artist. The renowned artists commissioned by NASA to record the flight of Columbia include: Lamar Dodd, Henry Casselli, Robert McCall, Arthur Shilstone, Wilson Hurley, Tom O'Hara, Jack Perlmutter, Bill Robles and William Philips.

There is much precedent for artists to record historic events such as a space flight. Artists have long recorded important events in American history, including the settlement of the West, the Civil War and World Wars I and II.

The work of artists who have participated in the NASA program has been used extensively in books, magazines, newspapers, motion pictures, television and even on postage stamps. Individual artists have received awards for their work.

The paintings, drawings and other works of art produced under the program become the property of NASA but they are frequently loaned to museums or other organizations for display.

Development of Spacelab Particle Accelerators in Final Stages

Scientists at Marshall Space Flight Center are performing final developmental tests for Marshall's portion of Spacelab 1's Space Experiments with Particle Accelerators. Marshall's Space Sciences Laboratory has been assigned the responsibility for developing the control data system and the flight applications software for the experiment and for supporting the five U.S. investigators.

The purpose of the experiments is to carry out active and interactive experiments on and in the Earth's ionosphere and magnetosphere.

These experiments fall within three major classes of investigation, which include vehicle charge neutralization, beam plasma physics and beam-atmosphere interactions. The first two investigations are mainly onboard plasma physics experiments to measure the effect of phenomena in the vicinity of Spacelab. The last one is concerned with atmospheric and magnetospheric modification and is supported by other Spacelab 1 investigations as well as by ground-based remote-sensing observations.

The particle accelerators experiment is funded jointly by the University of Tokyo and NASA.

Thirst at High Altitudes—NASA Ames U-2 pilot Jerry Hoyt demonstrates how he takes a drink of water at 70,000 feet. Hoyt is being fitted for a flight suit for the ER-2, NASA Ames newest high altitude aircraft.

Langley Goes International with Telelectures

NASA's Langley Visitor Center, Hampton, Va., recently presented a program on the Space Shuttle to the New Zealand Spaceflight Association. The program was conducted via a special satellite relayed conference telephone call, with the signal traveling approximately 22,000 miles into space to a communications satellite from which it was redirected to Wellington, New Zealand.

The telelecture programs are designed for students and organizations who are unable to travel to the center for an educational program. The one-hour presentations make use of conference telephone hookups (supplied by the requestor). After booking a telelecture, the teacher or group leader receives a tray of slides and an instructional letter. At the prescribed time, the lecturer places the call. The two-way conference hookup gives the students and the lecturer an opportunity for dialog. Though the Langley visitor center has presented many telelecture programs to schools and universities nationwide, the New Zealand telelecture was the first international presentation.

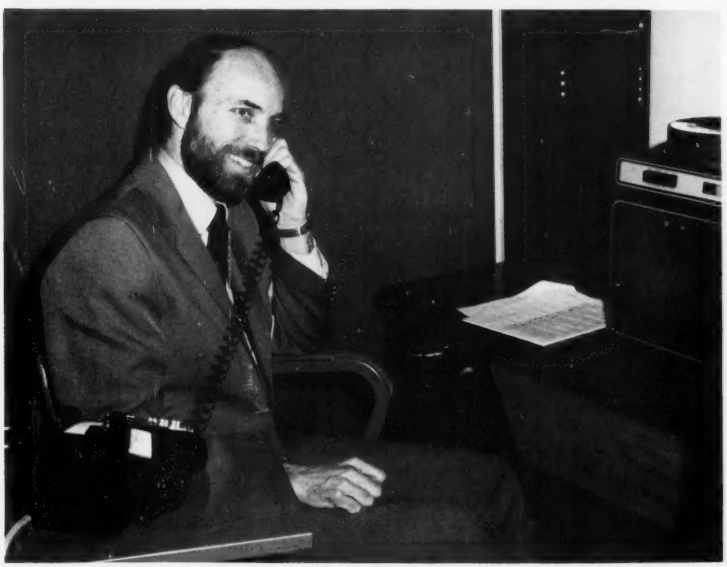
The New Zealand Spaceflight Association has maintained close contact with the Langley Research Center to keep abreast of current U.S. space projects. The Association works to publicize significant space missions, prepares displays, disseminates information and works closely wth the New Zealand news media.

The Langley Visitor Center began its telelecture program in 1978 with a series of programs to Charleston, S.C., on the Viking mission to Mars. The telelectures were so successful that the program was expanded. Eight telelectures, all developed by staff lecturer Ray Goodman, are now available through the Visitor Center: "NASA and Energy," "Flying Machines," "Exploration of the Solar System," "Space Shuttle," "Manned Spaceflight," "Satellites at Work," "Spinoffs from Space Research," and "Voyager: Mission to the Outer Planets." Additional topics to be presented by Langley researchers are now being developed. For further information on the Langley telelecture programs, call (904) 827–3341; (FTS) 928–3341.

Diamonds Found in Antarctic Meteorite

Tiny crystals of diamond, formed in an ancient cosmic catastrophe, recently have been found in a 10.4-kilogram iron meteorite collected from the antarctic ice cap in 1977. The discovery was reported in the magazine *Nature* by Roy S. Clarke Jr., Daniel E. Appleman and Daphne E. Ross, all of the Smithson an Institution's National Museum of Natural History.

The antarctic meteorite program is a joint activity of the National Science Foundation, the Smithsonian



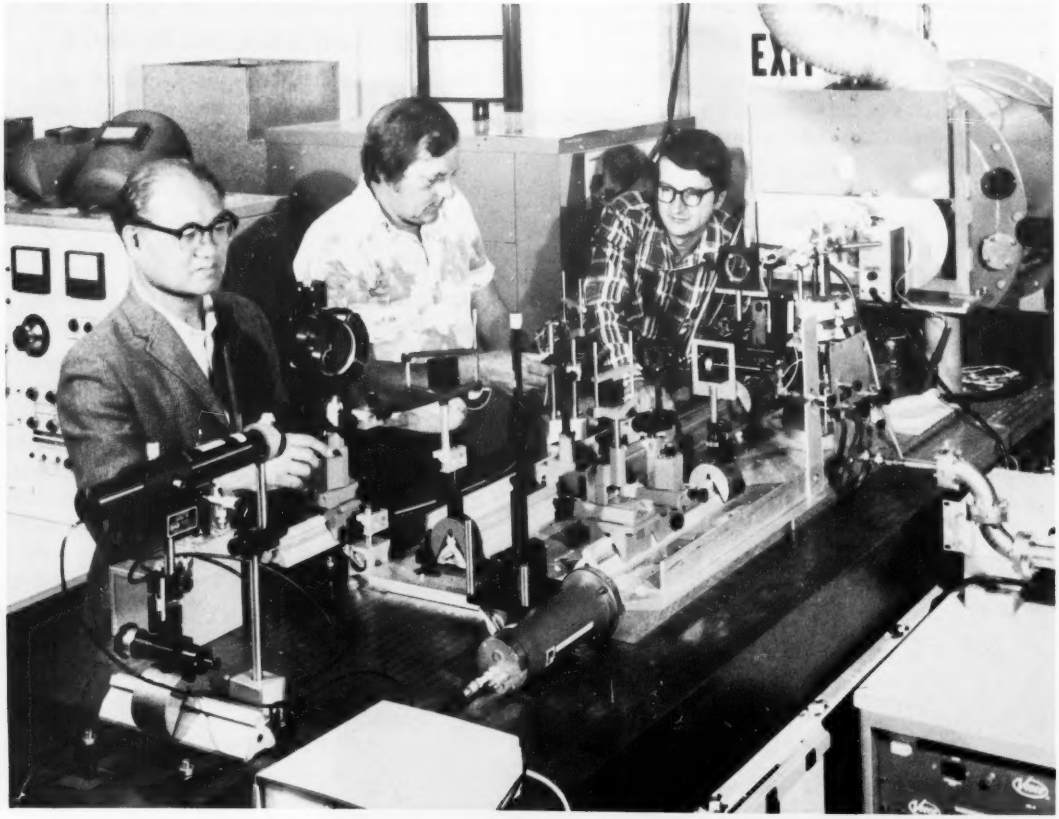
George Hastings, Program Manager, Langley Visitor Center, Hampton, Va., shown giving a telelecture.

Institution and NASA. The specimens are preserved, described and distributed by NASA's Planetary Materials Laboratory at Johnson Space Center, Houston.

This is only the second iron-type meteorite discovered to have diamonds within it. The other meteorite, the Canyon Diablo, was much larger on impact. Diamonds within the Diablo meteorite are believed to have been produced as a result of the shock pressure of impact when it hit the Earth. The antarctic meteorite is much smaller and would not have produced a sufficient shock when it hit the Earth—the diamonds therefore must have been produced as a result of a collision in space.

The diamonds, a type of crystalline carbon that forms at high pressures, were found as microscopic crystals in small carbon-rich fragments found inside the nickel-iron metal that makes up the meteorite. They were discovered when a saw used to slice the meteorite came up against one of the diamond-bearing inclusions and refused to cut further. X-ray studies then established the presence of diamond, together with two other forms of carbon: a rare mineral called lonsdaleite, chemically identical but a different crystal structure than diamond; and graphite, the familiar form of carbon used in lead pencils.

The tiny amounts of diamond found by Dr. Clarke and his colleagues have no commercial value. The meteorite is probably a fragment of an asteroid, and the diamonds in it bear witness to a great collision



Solar Laser—NASA researchers at the Langley Research Center, Hampton, Va., have achieved the first positive evidence of the solar pumping of a gas laser. Shown are researchers checking the apparatus used in the Langley study. The solar-powered lasar system is a structure which collects solar energy and directs it to a gas-filled tube which emits a high intensity light beam. The laser beam can be transformed into conventional energy forms such as electricity.

that probably took place in the asteroid belt many millions of years ago. Diamonds only form at high pressures, such as those existing deep within the Earth. In a small object like a meteorite, such high pressures can only be supplied by intense shock waves produced as asteroids collide with each other —or with the Earth—at speeds of tens of thousands of miles an hour.

The Canyon Diablo meteorite formed the mile-wide Meteor Crater in Arizona about 50,000 years ago. Diamonds in this meteorite occurred in the same way—as tiny crystals in carbon-rich inclusions in the metal.

"The diamonds in the Canyon Diablo meteorite seem to have formed when it hit the Earth and made Meteor Crater," said Dr. Clarke. "The shock waves produced by the impact converted natural carbon (graphite) in the meteorite into diamonds. But the antarctic meteorite is too small to have formed a crater. Being small it would have been slowed down as it came through the atmosphere, and it would have hit the ice at a low speed. So the diamonds must have formed before then, probably as the result of two asteroids colliiding with each other. This meteorite is a piece from the collision."

The diamond-bearing meteorite was collected in 1977 from the Allan Hills region of the antarctic, where more than a thousand new meteorite specimens have been found since 1976. Only nine of these meteorites are of the metallic (iron) type; the remainder are various kinds of stony meteorites.

Some of the special meteorites found in the antarctic include an extremely well-preserved carbon-rich specimen, a new family of stony meteorites, and another puzzling stone that seems almost 3 billion years younger than other meteorites.

NASA and German Ministry Sign Space Transportation Agreement

Dr. Alan M. Lovelace, NASA Acting Administrator and Hans-Hilger Haunschild, State Secretary, Ministry for Research and Technology of the Federal Republic of Germany signed a Memorandum of Understanding April 28 concerning the ministry's use of the Space Transportation System.

This agreement confirms general understandings for the terms and conditions under which NASA will furnish launch and associated services on a reimbursable and cooperative basis using the Space Transportation System. Specific launch services agreements or other formal agreements will be signed for each individual activity.

The Federal Republic of Germany has long been a supporter of Space Transportation System utilization and has contributed 40 percent to the European Space Agency development of the Spacelab. Spacelab is to be a major element in the Space Transportation System and will have facilities and equipment similar to laboratories on Earth but adapted for zero gravity.

The Federal Republic of Germany has already paid earnest money to NASA for two reimbursable Spacelab missions. The first Spacelab mission (D-1) will be for materials processing and life sciences experiments and the second Spacelab mission (D-4) is currently planned for astrophysics experiments. Current plans also called for a German X-ray satellite (Rosat) to be launched from the Space Shuttle in 1986, although no specific launch date has been reserved. Private and scientific organizations in Germany have also reserved a total of 25 small self-contained payloads for eventual flight on the Space Shuttle on a space-available basis.

Langley Offers Student Work Program

NASA's Langley Research Center is offering junior and senior high school students an opportunity to work with NASA researchers for eight weeks this summer.

The Summer Student Career Exploration Program, to be held June 15 through August 7, was established to allow juniors and seniors with career objectives in science, mathematics or engineering the chance to work with an engineer or scientist in the student's career interest area. Applications for the program closed April 30. The Langley program, funded by NASA Headquarters in Washington, D.C., has averaged 20 high school students each summer.

The program, which began in 1972, provides work experience in a student's interest area, an opportunity to see the applications of many concepts studied in the classroom and opportunities to gather information about related career areas which might reinforce or broaden a students' career objectives.

Ninety-five percent of the participating students have continued their education and majored in engineering or other related technological fields.

Awards Corner

Richard H. Petersen, Deputy Director of NASA's Langley Research Center, received the **Distinguished Engineering Alumnus Award** from Purdue University April 24 in a special ceremony at the university. He was one of the 11 graduates honored. Each year since 1964 the faculties of the engineering schools at Purdue have given the award to Purdue alumni "in recognition of outstanding achievements in professional and related fields of activities." Petersen graduated from Purdue in 1956 with a bachelor of science degree in aeronautical engineering, with highest distinction. Petersen has served as Deputy Director of Langley since July 1980, and is responsible for directing aeronautical research and technology activities and programs and for institutional management of all facilities and equipment.

Clyde Foster, Director of Equal Opportunity at the Marshall Space Flight Center, Huntsville, Ala., has been selected as one of the recipients of the biennial **Philip A. Hart Award**, which nationally recognizes individuals who have made a significant contribution toward improving urban and working environments. Foster, Marshall's Director of Equal Opportunity since 1979, received the award in Washington, D.C., March 25 from the Urban Environment Conference, an alliance of environmental, minority and labor groups, founded by the late Senator Hart of Michigan for whom the award is named. Foster was one of three recipients to be honored this year by the conference. He was cited principally for his work as Mayor of Triana, Ala., a small commuiity near Huntsville. During his 17-year tenure as mayor, Foster had been instrumental in establishing the first rural water and street lighting systems in the country in which Triana is located. He also helped to establish the first self-help housing development program for Alabama; to build a town hall and health clinic in Triana; and to promote the establishment of industries and employment in the town for disadvantaged minorities.

Dr. William R. Lucas, Director of NASA's Marshall Space Flight Center, Huntsville, Ala., was one of two recipients of an **Executive Leadership Award** from American University, Washington, D.C. The annual Roger W. Jones Award for Executive Leadership was presented May 9 to two federal career executives "who have demonstrated superior leadership resulting in outstanding organizational achievements and a strong commitment to the effective continuity of government through development of government managers and executives. Lucas became Director of Marshall in June 1974 after having served four years as deputy director. He has been with Marshall and its predecessor organizations for almost 30 years in scientific and program management positions.

Dr. Walter C. Williams, NASA's Chief Engineer, received the **Federal Engineer of the Year Award** from the National Society of Professional Engineers in February. The Society also named Williams as **NASA's Engineer of the Year**. Williams was appointed as Chief Engineer in October 1975. In this position he makes assessment of all NASA programs to assure technical excellence and engineering soundness. Previous to his appointment, Williams was with Aerospace Corporation from April 1964 until October 1975 as General Manager, Vehicle Systems Division, and Vice President and Special Assistant for Test Range Operations. Williams had been associated with NASA from September 1961 until November 1963 as Associate Director of the then NASA Manned Spacecraft Center. He was responsible for Mercury operations including factory checkout, preparations, launch activities, inflight activities, recovery and postflight analysis, and future flight planning.

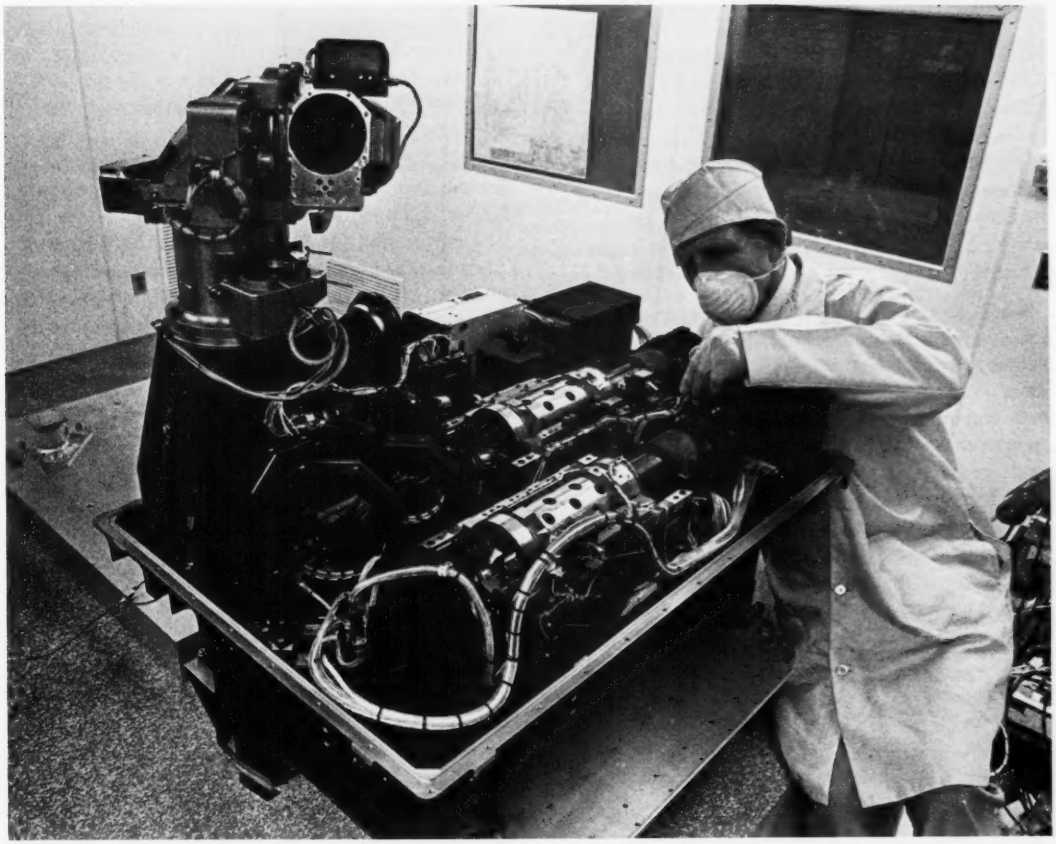
Bruce A. Banks, chief of the In-Space Research and Technology Section, Lewis Research Center, Cleveland, has been selected to receive the **1980 Arthur S. Fleming Award** which honors outstanding young men and women in the federal service. Banks is one of 10 recipients selected for the award; five are given in the scientific and technical fields and five in the executive administrative fields. Banks was chosen for his "outstanding achievement in developing a program applying NASA space technology for the direct benefit of mankind in biomedical devices." Working with medical researchers, Banks produced unique micro-textured surfaces on a variety of materials used in prostheses and surgical implants. He demonstrated that materials whose surfaces were modified by exposure to the beam of an ion thruster, originally developed for spacecraft propulsion, produced markedly different and more favorable response when implanted in body tissues.

Donald A. Beattie, Director, Energy Systems Div., Office of Aeronautics and Space Technology, Hdqs., was recently honored by California's San Diego County for hosting the Director of the San Diego County Energy Office as an Intergovernmental

Affairs Fellow from September 29 to Dec. 10. Beattie was presented a certificate in March citing a resolution of thanks and appreciation by the county for Beattie's expertise and guidance in "national energy policy formulation and implementation, new energy technologies and management techniques" which will greatly benefit San Diego County. **Paul Brockman**, Manager of Intergovernmental Affairs, received a similar citation for his efforts in negotiating the assignment.

Did You Know?

Two NASA motion pictures, *Space Shuttle—Mission for the Future*, and *Space for Women* have been selected by the Council on International Nontechnical Events to receive Golden Eagle Awards, a coveted award for U.S. documentaries. The Council judges U.S. documentaries to represent U.S. cinematography in international festivals abroad. Jim Kukowski, Public Information Officer for Space



Sensor Tested for Future Space Shuttle Mission—NASA's Atmospheric Trace Molecule Spectroscopy (ATMOS) sensor shown undergoing system integration tests at Honeywell's Electro-Optics Operations Center, Lexington, Mass. The sensor, developed under contract to NASA's Jet Propulsion Laboratory, Pasadena, Calif., is an advanced global atmospheric survey instrument designed to identify and measure a wide range of known and potential molecular species in the altitude region from 20 to 120 kilometers. The sensor is a rapid scan, high-resolution Fourier Transform Spectrometer, capable of high-sensitivity measurements over a wide infrared spectral region. Recent tests have qualified the sensor through simulated shuttle launch vibrations and have demonstrated the spectral capabilities of the system. The first in a series of shuttle flights for the ATMOS sensor is currently scheduled as part of the Spacelab 3 mission, scheduled for flight in 1984.

Transportation Systems, was technical advisor for the Space Shuttle film; Curtis Graves, Deputy Director, Academic Affairs Div., was technical advisor for *Space for Women*. NASA's Motion Picture Producer, Byron Morgan, produced *Space Shuttle—Mission for the Future*; Morgan and NASA retiree Ken Grimm supervised production of *Space for Women*.

Thousands of space enthusiasts and Shuttle well wishers flocked to the Mid-Town Plaza in Rochester, N.Y., on April 13 to sign an enormous scroll, measuring 27 feet long by 3½ feet wide inscribed with the following message: "To Columbia: Thanks for putting us back in Space." The message scroll was the idea of radio station WHFM-FM99 in Rochester. Kelly McCann, program director for WHFM and Marc Cronin, music director for the station, were on hand to broadcast the Shuttle sign-in live from the plaza for a three-hour period—over 2,500 signatures were collected. The scroll, to be presented to *Columbia's* astronauts, John Young and Bob Crippen, was on display at NASA Headquarters lobby in Washington, D.C., the last weeks of April.

NASA inventors can receive monetary awards for their creativity. In accordance with the provisions of Section 306 of the National Aeronautics and Space Act of 1958, as amended, all NASA and NASA contrator employees engaged in aeronautical or space research and development work are eligible for consideration for monetary awards when they create and report new concepts and technology to NASA. Innovations do not necessarily need to be inventions but can include any scientific or technical contribution which has merit or utility to space or aeronautical activities including, for example, computer programs.

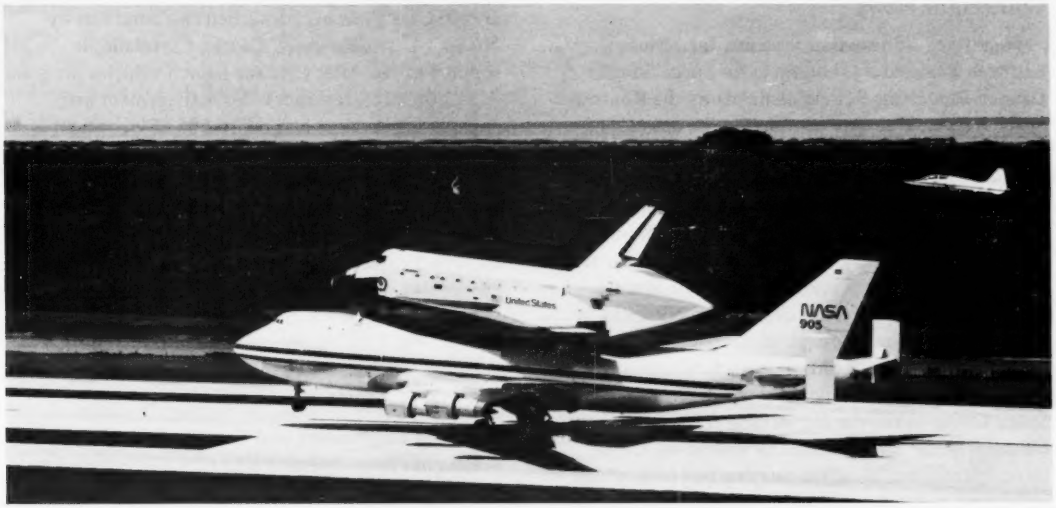
Each month NASA's Inventions and Contributions Board convenes to consider contributions which are considered to be of significant value in the conduct of aeronautical or space activities, or that have commercial application. The Board recommends to the Administrator the dollar amount of the award which can range from $100 to thousands of dollars. The minimum award granted ($100) is given when a technical brief is approved by the Center Technology Utilization Officer for publication; $150 is awarded when a patent application is authorized for filing by the Center Patent Counsel. Before any item receives a higher award it undergoes extensive study and evaluation. The Award Evaluation Questionnaire (NASA Form 1329), originated through the Center Awards Liaison Officer to the inventor's or innovator's management, is an important part of this process. In 1980 there were 75 awards of $250 or more granted, 19 of which were for at least $1,000.

To become eligible for an award the innovation must first be submitted through one of several channels for consideration by the Inventions and Contributions Board. In order to obtain helpful directions, NASA employees should contact their Center's Technology Utilization Office, Awards Liaison Office, or Patent Counsel's Office. Consideration will be given by these offices to further processing of the new technology reports into NASA Tech Briefs or patent applications or both. NASA contractor employees should first contact their company's new technology representative or contract monitor. These individuals will initiate the necessary steps whereby reports of new technology are submitted to NASA.

If further assistance is needed, contact the Chief, Awards Branch, Inventions and Contributions Board, NASA Headquarters, by calling (202) 755-3585.

A new exhibit devoted to the Space Shuttle opened April 6 at the Smithsonian's National Air and Space Museum. Entitled "America's Space Truck—The Space Shuttle," the exhibit features a 16-foot model of the Space Shuttle *Columbia* on its launch pad, thermal protection tiles from the Shuttle's exterior and models of future payloads. Completing the exhibit are numerous photographs and models highlighting the development of this unique aerospace vehicle.

Idea Clearinghouse this month cites Lewis Research Center for linking computer terminals by co-axial cable. The same type of cable that is used for cable TV transmission is being installed in a loop around the center to transmit data between the central computer facility and terminals located in various buildings. At present remote computer terminals are connected directly to the central computer by individual incoming wire pairs. Under the new system the signals will be directed by microprocessors connecting each individual terminal to the coaxial cable. The cable allows a data transmission rate 1,000 times faster than the direct wire system at one million characters per second. It will also permit the broadcast equivalent of up to 50 television channels, and is capable of inter-building audio-visual transmission. Additional information on the details of this system and its potential applications may be obtained by contacting Roger Schulte, Project Manager for the system, on FTS 294–6375.



Shuttle Returns Home—The Space Shuttle *Columbia* mounted atop the modified 747 Shuttle Carrier Aircraft (top photo) arrived at the Kennedy Space Center's Shuttle Landing Facility on April 28, after a two-day journey from NASA's Dryden Flight Research Center, Edwards, Calif. The Shuttle landed on a runway at Rogers Dry Lake, Edwards, Calif., on April 14 at the conclusion of a 2½-day mission. The *Columbia* underwent a two-week deservicing and checkout period at Dryden, departing atop the 747 for Kennedy on April 27 and stopping overnight at Tinker Air Force Base near Oklahoma City, Okla. Shown below, the *Columbia* and Shuttle Carrier Aircraft are parked in front of the Mate/Demate Device at Kennedy's Shuttle Landing Facility where the orbiter is hoisted off the 747. At background center, is Kennedy's Vehicle Assembly Building where the *Columbia* will be mated with a new external tank and twin solid rocket boosters for its second orbital flight test, now scheduled for Sept. 30. The second launch of the *Columbia* will take place at Kennedy's Launch Complex 39A.

Contractor News

Honeywell Information Systems, Inc., McLean, Va., has been awarded two contracts for Space Shuttle Launch Processing System elements by the Kennedy Space Center, Fla. One contract, in the amount of $19,422,731 provides for computers and software system support services at Vandenberg Air Force Base, Calif.; the other contract, in the amount of $10,750,331 provides parallel services for Kennedy Space Center, Fla. The Launch Processing System controls and performs much of the Space Shuttle vehicle checkout automatically while the vehicle components are being prepared for launch. Vandenberg will be the site of Shuttle launches requiring payloads launched in a north-south orbit; Kennedy Space Center is the site for all orbital flight test launches of the Space Shuttle as well as the site of those operational launches carrying payloads which require an east-west orbit. The Vandenberg contract performance period extends from June 1, 1981 through Sept. 30, 1982. Annual options may be exercised thereafter which would extend through Sept. 30, 1986 and bring the potential aggregate value of the contract to $34,032,479. The Kennedy Space Center contract performance period extends from Sept. 1, 1981 through Sept. 30, 1982. Annual options may be exercised thereafter which would extend the contract through Sept. 30, 1986 and bring the potential aggregate value of the contract to $62,286,698.

Englehard Industries Div., Englehard Minerals and Chemicals Corp., Iselin, N.J., has been awarded a $4,799,000 contract by NASA's Lewis Research Center, Cleveland, to develop and test a fuel cell powered energy system. The cost-sharing contract serves as Phase Three of the Full Scale Power Plant Development Program which Lewis manages for the Department of Energy. This program is designed to test the use of fuel cells in a totally integrated energy system which would provide all of the heating and cooling, hot water and electrical needs for a small office building, retail store or apartment building.

General Dynamics Corp., Convair Div., San Diego, Calif., has been awarded two contracts by NASA's Lewis Research Center, Cleveland, in support of the Atlas Centaur launch vehicles program. A $12,685,213 contract is for management and engineering services and a $16,506,229 contract is for launch operations and test support services, through Dec. 31, 1981. Both are cost-plus-award-fee contracts and are continuations of work performed under earlier contracts with Convair. The management and engineering support activities will be carried out principally at the Convair plant in San Diego and also at the Eastern Space and Missile Center, Fla. Launch operations and test support activities will be carried out at the Eastern Space and Missile Center.

Boeing Engineering and Construction Co., Seattle, Wash., has been awarded a $3,623,227 contract by NASA's Lewis Research Center, Cleveland, for analysis, operation and maintenance for the two-year test of the Mod-2 wind turbine project at Goodnoe Hills, Wash. The cost-plus-fixed-fee contract is a continuation of work sponsored by the Department of Energy and performed under a previous contract between NASA and Boeing. The Mod-2 project is the nation's first "wind farm," comprised of three 2.5 megawatt wind turbines. Together the turbines generate enough power to provide electricity for about 2,000 average homes. NASA's Lewis Research Center has management responsibility for the Department of Energy's large experimental wind turbine program.

REguard Security Service, Inc., New Orleans, La., has been awarded a $1,650,492 contract by the Small Business Administration for security and fire protection of NASA's Michoud Assembly Facility, New Orleans. The labor-hour-type contract calls for REguard to provide services for a period of one year with a one-year extension option. The contract is managed for the Marshall Space Flight Center, Huntsville, Ala., by the manager of the Michoud Facility.

Space Shuttle Launches for 1981

Orbiter	Launch Date	Launch site	Payload
OV-102	April 12	KSC	
OV-102	Sept. 30	KSC	OSTA-1 DFI (with IECM)

Patents for Inventions from NASA Research

The office of General Counsel, NASA Headquarters, announces that the following U.S. patents have been issued by the U.S. Patent Office to NASA for inventions resulting from NASA research. Inquiries concerning them should be directed to the attention of the NASA Patent Counsel of the indicated installation.

Inventor(s) and Employer	Title	Patent No.	Installation
Wolfgang Fuhr, U.S. Radium ..... Lighting Products Div., Parsippany, N.J.	Method for applying photographic resist to ..... otherwise incompatible substrates	..4,262,080	JSC
Paul R. White and Donald R. Scott, ... NASA/MSFC	Solar tracking system	4,262,195	MSFC
Walter Viehmann, NASA/GSFC	Fluorescent radiation converter	4,262,206	GSFC
Steve D. Gaalema, Caltech/JPL, ... Pasadena	CCD correlated quadruple sampling processor	4,262,258	NRO/JPL
Satoshi Nagano, Caltech/JPL, ... Pasadena	Low current linearization of magnetic amplifier for .. DC transducer	4,262,259	NRO/JPL
John R. Aylward, Hamilton Standard, ... Windsor Locks, Ct.	Cell and method for electrolysis of water ..... and anode therefore	4,263,112	JSC
Billy R. Ashworth, Alton C. Hall ..... and Clyde E. Clark, NASA/LaRC	Helmet weight simulator	4,264,310	LaRC
Judd R. Wilkins, NASA/LaRC	Indirect microbial detection	4,264,728	LaRC
Guy M. Pelchat, George G. Rassweiler .... Anthony J. Gianatasio, Lock R. Young, The Harris Corporation, Melbourne, Fla.	Adaptive polarization separation	4,264,908	LaRC
Tage O. Anderson, Caltech/JPL, ... Pasadena	High speed multiplexing of keyboard data inputs	4,266,743	NRO/JPL
Louis P. Leblanc, NASA/DFRC	Thermocouple, multiple junction reference oven	4,264,802	DFRC
Kent D. Castle, NASA/JSC	Shielded conductor cable system	4,264,940	JSC
Liam R. Jackson, John P. Weidner, ... William J. Small, and James A. Martin	Orbiter/launch system	4,265,416	LaRC
Frank J. Nola, NASA/MSFC	Power factor control device for ac induction motors ..	4,266,177	MSFC
Wendell W. Kelley, NASA/LaRC	Pitch attitude stabilization system utilizing engine .... pressure ratio feedback signals	4,266,743	LaRC
Lawrence P. Ludwig, NASA/LeRC	Circumferential shaft seal	4,266,788	LeRC
John W. Brunson, NASA/KSC	Decommutator patchboard verifier	4,267,594	KSC

Expendable Launches for 1981

Name	Launch Date	Vehicle	Range	Mission Remarks
COMSTAR-D	February 21	Atlas Centaur ..	ESMC	Comsat General Corp. communications. Reimbursable.
GOES-E	May 22	Delta	ESMC	NOAA weather. Reimbursable.
Intelsat V-B	May 23	Atlas Centaur ..	ESMC	Intelsat communications. Reimbursable.
Navy 20 (NOVA 1).	2nd quarter	Scout	WSMC	DOD transit. Reimbursable.
NOAA-C	June 22	Atlas-F	WSMC	NOAA weather. Reimbursable.
FLTSATCOM-E ..	June	Atlas Centaur ..	ESMC	DOD communications. Reimbursable.
Dynamic Explorer .	July	Delta	WSMC	NASA scientific.
Intelsat V-C	August	Atlas Centaur ..	ESMC	Intelsat communications. Reimbursable.
SBS-B	August	Delta	ESMC	SBS communications. Reimbursable.
Solar Mesospheric . Explorer	September	Delta	WSMC	NASA scientific.
RCA-D	October	Delta	ESMC	RCA communications. Reimbursable.
NOAA-D	October	Atlas-F	WSMC	NOAA weather. Reimbursable.
RCA-C1	December	Delta	ESMC	RCA communications. Reimbursable.
Intelsat V-D	December	Atlas Centaur ..	ESMC	Intelsat communications. Reimbursable.
Navy 21 (NOVA 2).	4th quarter	Scout	WSMC	DOD transit. Reimbursable.

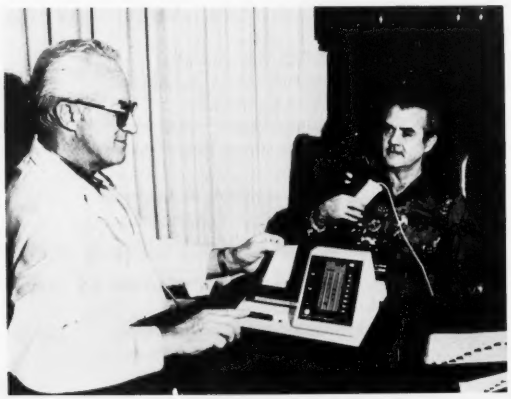
Another Dividend from Air and Space

Research and development in aeronautics and space have provided numerous benefits for all Americans—and at a tiny percentage of the tax dollar. Here is an example:

Programmable Pacemaker

NASA technology used to send coded information to unmanned satellites or to receive data from satellites has been employed by Pacesetter Systems, Inc., Sylmar Calif., in the manufacture of two-way communication pacemakers which allow a physician to reprogram a patient's implanted heart device without surgery. Introduced in 1979, Pacesetter's Programalith* system consists of the implantable pacemaker together with a physician's console containing the programmer and a data printer. The physician communicates with the patient's heart device via wireless telemetry signals transmitted through a communicating head held over the patient's chest (see photo below).

Earlier design pacemakers only deliver a fixed type of stimulus once implanted. The Programalith system enables surgery-free "fine tuning" of the device to best suit the patient's needs which may change over time with changes in physical condition. The system permits a physician to reset as many as six different heart stimulating functions of the pacemaker. Once a physician programs an instruction for change



in a pacemaker's stimulus parameters, a return signal confirms that the change has been made as instructed. When reprogramming is complete, the system prints out a copy of the new settings for the patient's record.

The two-way communications capability also enables a physician to interrogate the device on the status of its interaction with the heart.

Another space technology application, known as pulse code modulation, has provided a "stimulus dependability" safeguard for programmable pacemakers; it ensures that the pacemaker will accept only properly coded instructions and will not respond to false signals generated by electrical noise or other interference.

* Programalith is a registered trademark of Pacesetter Systems, Inc. NASA does not endorse commercial products developed as a result of its Technology Utilization or Patent Licensing Programs, but does encourage the widest possible use of such technology.

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For the benefit of all . . .

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